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Eating locations and occasions by energy and nutrients food sources among adolescents and young adults

Locais e ocasiões das refeições e alimentos fontes energia e nutrientes entre adolescentes e jovens adultos

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ABSTRACT

Objective

This study aimed to estimate the daily energy intake and overconsumed nutrients for adolescents and young adults concerning public health based on the food source, eating location, and occasion.

Methods

This study constituted a cross-sectional analysis of the 2015 Health Survey of São Paulo focusing on Nutrition with 707 adolescents ($n=554$, 12-19 years) and young adults ($n=153$, 20-30 years). Dietary intake was measured using 24 h recall, and energy, added sugars, sodium, and saturated food sources were calculated. Foods were classified using the "What We Eat in America?" classification system. Eating locations were divided into two categories—at home and away from home—for each main meal (breakfast, lunch, and dinner). Other sociodemographic and weight status variables were included. Descriptive statistics, the Wald test, and proportion rates were applied for analysis.

Results

Most meals were consumed at home by 80.5% of adolescents and 66.4% of young adults. Young adults consumed more daily calories and saturated fats than adolescents. Both adolescents and young adults consumed equal daily saturated fatty acids, sodium, and added sugars away from home at dinner. Food consumed at home was consumed both at home and away from home, with the main exception of dinner, which consisted of mainly processed foods rich in saturated fatty acids, sodium, and added sugars consumed away from home.

Conclusion

Adolescents and young adults had meals higher in fat, sugar and sodium away from home than those who ate at home when eaten at dinner. Public health policies and behavioral change strategies should be considered independently of where their meals are consumed but with particular attention to eating occasions.

Keywords: Adolescent. Young Adult. Diet. Food. Cross-Sectional Studies.

RESUMO

Objetivo

Este estudo teve como objetivo estimar a ingestão diária de energia e nutrientes de maior preocupação em saúde pública entre adolescentes e jovens adultos, com base nos alimentos fonte, local e tipo de refeição.

Métodos

Este estudo é de delineamento transversal que utilizou dados do Inquérito de Saúde do Município de São Paulo 2015 (ISA-Capital) focado na Nutrição. A amostra compreendeu 707 adolescentes ($n=554$, 12-19 anos) e adultos jovens ($n=153$, 20-30 anos). O consumo alimentar foi avaliado por meio do Recordatório Alimentar de 24h (R24H) e a calculou-se as fontes de energia, açúcar de adição, sódio, e gordura saturada. Os alimentos foram classificados pelo sistema de classificação "What We Eat in America?" Os locais de alimentação foram divididos em duas categorias – "em casa" e "fora de casa" – para cada refeição principal (café da manhã, almoço e jantar). Outras variáveis sociodemográficas e antropométricas foram incluídas. Estatísticas descritivas, teste de Wald e proporções foram aplicadas para análise.

Resultados

A maioria das refeições era consumida em casa por 80,5% dos adolescentes e 66,4% dos adultos jovens. Os adultos jovens consumiam mais calorias diárias e gorduras saturadas do que os adolescentes. Tanto adolescentes, quanto adultos jovens, consumiam majoritariamente ácidos graxos saturados, sódio e açúcares de adição fora de casa, no jantar. Os alimentos consumidos em casa eram consumidos tanto em casa quanto fora de casa, com a principal exceção do jantar, que consistia, principalmente, em alimentos processados ricos em ácidos graxos saturados, sódio e açúcares de adição consumidos fora de casa.

Conclusão

Adolescentes e adultos jovens apresentaram refeições mais ricas em gordura, açúcares e sódio fora de casa em comparação com aqueles que consomem em casa quando consumidos no jantar. Políticas de saúde pública e estratégias de mudança de comportamento devem ser consideradas independentemente do local onde suas refeições são consumidas, mas com especial atenção ao tipo de refeição.

Palavras-chave: Adolescente. Adulto jovem. Dieta. Alimentação. Estudos Transversal.

INTRODUCTION

Food environments have been defined as physical, economic, policy, and socio-cultural spaces and as an opportunity to impact food choices and weight status [1]. Many aspects of food environments, such as eating occasions and location, meal patterns, and overall timing of dietary intake, are influenced by socio-cultural norms [2]. Thus, given the complexity of diverse food choices, eating occasion and location are intrinsically linked. Many studies [3-6] have examined eating occasions, focusing on those socially or culturally described as "breakfast," "lunch," "dinner," and "in-between or smaller meals" (i.e., "snacks") [7]. Alternatively, few studies have focused on different eating locations, such as eating at home or away from home (including restaurants, fast food, take-out food, and others) [8-12]. Thus, at the physical environmental level, individual eating patterns can be influenced by the location of food preparation and consumption [13], and a deeper understanding of this relationship is needed to guide interventions aiming to improve dietary intake.

Poor dietary intake and unhealthy weight are increasingly common among adolescents and young adults [14,15], and these may be associated with the location of where they eat their meals [7]. For example, a study of over 4,000 US individuals found that eating at home increased the chance of consuming more fruit and vegetables [16]. Conversely, consuming foods away from home was associated with increased saturated fats and decreased overall diet quality scores [17].

Evidence from high-income countries [8-10,16,17] has shown that eating away from home is associated with food sources of energy and the overconsumption of nutrients that are concerns for

public health, namely saturated fats, sodium, and added sugars [18,19]. Eating away from home differs according to a country's economic status [20]. This is especially true among younger individuals in low- and middle-income countries, who consume more discretionary foods. For example, data from the Brazilian Household Budget Survey 2008–9 regarding adolescents ($n=5,266$) showed that consuming foods away from home increased adolescents' intake of baked and deep-fried snacks, soft drinks, sandwiches, pizza, and desserts [21]. Similarly, a study conducted in Santiago, Chile, with children and adolescents showed that most of the added sugars, and fat food sources were consumed at home, with sugar-sweetened beverages (SSBs) as the primary source. This suggests that eating from home can increase the intake of these nutrients instead of foods consumed at school and other venues [22]. These studies suggest that further research is needed in low- and middle-income countries. To fill this gap, this study used nutritional data from a population-based study from Sao Paulo, the largest Brazilian city, to: (i) estimate adolescents' and young adults' daily intake of energy and overconsumed nutrients of public health concern (i.e., saturated fats, sodium, and added sugars) by food source and eating location/occasion and (ii) determine the food sources of energy and overconsumed nutrients by eating location/occasion.

METHODS

The 2015 Health Survey of São Paulo ("ISA-Capital" in Portuguese) is a cross-sectional household survey that used two-stage cluster sampling (census tract and households), as well as regional health offices (North, Central-West, Southeast, South, and East), age (12 years or older), and sex, to estimate a representative sample of the residents of São Paulo, Brazil. The 2015 ISA-Capital was conducted according to the guidelines of the Declaration of Helsinki and approved by the Research Ethics Committee of the School of Public Health of the University of São Paulo (protocol code number: 36607614.5.0000.5421) on October 8, 2014.

Study Sample

The survey's necessary sample size was calculated to be 4250 participants to allow for a 0.50 population proportion to be estimated, with a sampling error of 0.10 considering a 95% confidence level and a design effect 1.5. A total of 4043 participants (56.3% women, 36.3% adolescents, and young adults) agreed to participate in the 2015 ISA-Capital. Of these participants, 1742 were randomly selected to be included in the 2015 ISA-Nutrition subsample. An overview of the 2015 ISA-Capital and ISA-Nutrition, including the purpose, plan, operations, sample design, weighting procedures, analytic guidelines, response rates, and population totals, is available from previous studies [23,24].

The World Health Organization (WHO) defines adolescents as anyone between 10 and 19 years old [25], and previous studies have identified young adults as between 20–30 years old [15]. The Brazilian Statute for Children and Adolescents categorizes the age range for adolescents according to Brazilian law; thus, adolescents are considered individuals aged between 12 and 19 years. Therefore, data from individuals aged 12–30 who participated in the 2015 ISA-Nutrition and answered the 24-h dietary recall (24HR) were used for this analysis ($n=707$). Sociodemographic information and self-reported weight status and diet were obtained from the 2015 ISA-Capital questionnaire. The ISA-Capital employs protocols and procedures that ensure confidentiality and protect individual participants' identities [23,24].

Variables

Categorical variables were sex (male/female), race (Caucasian/non-Caucasian), place of birth (born in São Paulo/born elsewhere), marital status (married or living with partner/single or living alone), and educational background (\leq high school/college or graduate degree); for adolescents, these variables corresponded to the head of household. Continuous variables were age (years), number of people in the home, family income (Brazilian real [conversation rate: US\$1.00=R\$4.00]), and number of children in the household. Self-reported weight and height were used to calculate participants' body mass index (BMI) and classify them accordingly to their weight status categories: (i) young adults' weight status was determined using WHO cut-off points for ≥ 20 –60-year-olds [26]; and (ii) adolescents (≥ 12 –19 years), sex- and age-specific cut-off points were used as per the WHO BMI Z-scores [27]. A previous study found the ISA-Nutrition's self-reported measurements valid and reliable [28].

Dietary Data

Dietary intake data were collected via an in-person interview using 24-hour dietary recall as per the automated multiple-pass method [29]. Participants were instructed to report their food consumption in household measures and food item preparation methods, ingredients, and brands to improve consistency and avoid possible bias. In this study, we used a single 24 h dietary recall, which, when administered in a sufficiently large sample, can adequately be used to estimate mean usual dietary intake [30]. Nutrient analysis (including energy, macronutrient, and micronutrient values) for the recorded foods and beverages was done using the Nutrition Data System for Research (NDSR, version 2014, University of Minnesota, USA). The NDSR utilizes the United States Department of Agriculture food database; therefore, a concordance rate of at least 80–120% for energy and macronutrient content was required to establish an equivalence of local foods to NDSR foods. Added sugars included monosaccharides, disaccharides added as caloric sweeteners, and white sugar included in recipes (beverages or foods). Total sodium intake comprises the sodium naturally present in food that is added for flavor during preparation. Saturated fat constitutes the intake of Saturated Fatty Acids (SFAs) (no double bonds) [31].

The “What We Eat in America” food classification system [32] has been adapted and used to classify all foods consumed in Brazil and seven other Latin American countries [18,33]. For the adaptation, data from over 9,000 individuals were used to create an extensive database listing the energy and nutrient content of all foods and beverages consumed by this population. Under this food classification system, each food code is assigned to one of 131 food categories (e.g., pizza; ready-to-eat cereals, higher in sugar; and milk, whole), which are organized within subgroups ($n=46$; e.g., mixed dishes-pizza; ready-to-eat cereals; milk, respectively) and significant groups ($n=15$; e.g., mixed containers; grains; milk and dairy, respectively). Different eating habits are observed as the ISA-Capital targets a representative sample of individuals living in Brazil's largest city. This yields the need to include new food items in specific mixed-dish categories, such as bean-mixed dishes (e.g., *feijoada* and *acarajé* [fried bean cake]), pasta-mixed dishes, and Asian (mainly Japanese)-mixed dishes.

For each food or beverage reported in the 24 h dietary recall, each participant was asked to indicate the location where they ate/drank it. These were classified into two eating locations: (i) at home, including participants', family members, and friend's homes, and (ii) away from home, including community centers, work, school, and restaurants (e.g., dining, take-out, and fast-food restaurants).

Meals were based on the time when food was consumed: 6–10 am for breakfast, 12–3 pm for lunch, and 6–9 pm for dinner. Eating occasions, focusing on those socially or culturally, was described as “breakfast,” “lunch,” “dinner,” and “in-between or smaller meals” (i.e., “snacks”). Everything that did not comprehend these times was considered “in-between meals” [7].

Data Analysis

All analyses used Stata (version 13.1., 2013, College Station, Texas, USA). Descriptive statistics were calculated for participants’ socio-demographic characteristics. Stratified by age groups, the Wald test was calculated to verify the mean [standard deviation (SD)] differences between eating locations and nutrients consumed. Food energy sources added sugars, sodium, and saturated fats were estimated in the proportions (frequency, percentage) consumed in each eating location. Sample weights, clusters, and strata were considered for the complex study design to ensure the study’s representativeness. A significant level of 5% ($p < 0.05$) was considered for all tests.

RESULTS

Table 1 presents adolescents’ and young adults’ sociodemographic and lifestyle characteristics. The majority (52.22%) of participants self-identified as men. Mean (SE) age was 15.61 (0.10) years for adolescents and 23.91 (0.26) years for young adults. Most meals were consumed at home for adolescents (80.5%) and young adults (66.40%). Table 2 shows energy and overconsumed nutrient (i.e., added sugars, sodium, and saturated fats) intake by eating location and occasion. Young adults showed a significantly higher intake of calories and saturated fats than adolescents. Both young adults and adolescents also showed a significantly higher intake of saturated fats, sodium, and added sugars consumed at dinner away from home than at home. Tables 3 and 4 present the top food contributors of energy and overconsumed nutrients of public health concerns according to different eating locations and occasions.

Table 1 – Sociodemographic and lifestyle characteristics of adolescents and young adults (n=707). Health Survey of São Paulo with focus on Nutrition, 2015.

Characteristics	Total (n=707)	Adolescents (n=554)	Young adults (n=153)
	M (SE)	M (SE)	M (SE)
Age, years	18.66 (0.23)	15.61 (0.10)	23.91 (0.26)***
People living at home	3.19 (0.06)	3.34 (0.05)	2.71 (0.18)**
Family income ¹	1848.83 (112.52)	1838.8 (125.6)	1867.3 (222.2)
Weight (kg)	62.12 (0.55)	58.85 (0.62)	63.62 (1.17)***
Height (cm)	1.65 (0.00)	1.63 (0.01)	1.68 (0.01)***
BMI (kg/m) ²	22.65 (0.18)	21.93 (0.19)	23.86 (0.38)***
Energy (kcal/day)	2180.85 (32.47)	2074.85 (32.46)	2291.4 (58.75)
Characteristics	Total (n=707)	Adolescents (n=554)	Young adults (n=153)
	n (%)	n (%)	n (%)
Sex (p-value*)			
Male	364 (52.22)	282 (50.85)	82 (54.57)
Female	343 (47.78)	272 (49.15)	71 (45.43)
Race/Ethnicity (p-value**)			
Caucasian	288 (41.85)	229 (40.07)	59 (38.00)
Non-Caucasian	411 (58.15)	319 (55.93)	92 (62.00)
Place of Birth (p-value**)			
Born in São Paulo	601 (82.66)	498 (91.15)	103 (68.05)
Other States/Country	104 (17.34)	54 (8.85)	50 (31.95)
Marital Status (p-value**)			
Married or living with a partner	70 (14.89)	14 (2.43)	56 (36.32)
Single or living alone	634 (85.11)	537 (97.57)	97 (63.68)

Table 1 – Sociodemographic and lifestyle characteristics of adolescents and young adults (n=707). Health Survey of São Paulo with focus on Nutrition, 2015.

Characteristics	Total (n=707)	Adolescents (n=554)	Young adults (n=153)
	n (%)	n (%)	n (%)
Educational Background ² (p-value*)			
≤High school	316 (43.86)	258 (47.65)	58 (37.45)
College/University degree	349 (56.14)	261 (52.35)	88 (62.55)
Weight Status (p-value*)			
Underweight	18 (3.16)	12 (2.94)	6 (4.94)
Normal weight	454 (65.74)	362 (68.54)	92 (61.03)
Overweight	142 (21.62)	102 (18.92)	40 (26.17)
Obese	68 (9.48)	56 (10.45)	12 (7.86)
Eating Occasions (p-value**)			
Breakfast	624 (88.26)	500 (90.25)	124 (81.05)
Lunch	667 (94.34)	526 (94.95)	141 (92.16)
Dinner	580 (82.04)	461 (83.21)	119 (77.78)
Snacks	636 (89.96)	498 (89.89)	138 (90.19)
Meal Location (p-value**)			
Home	554 (78.30)	446 (80.50)	102 (66.40)
Away from home ³	153 (21.70)	108 (19.50)	51 (33.60)

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. ¹Family Income was reported in Brazilian Reals (R\$). By the time of data collection (2015), the conversion rate was US\$ 1,00 = R\$ 4,00. ²The head of the family. ³Away from home = fast foods, takeaway restaurants, eating at school, workplace, and community meal programs. Chi-squared tests were used for categorical variables, and for continuous variables, t tests were used to verify possible associations. SE: Standard Error.

Table 2 – Mean (standard error) of energy and nutrients of public concern by eating locations and occasions among adolescents and young adults: Health Survey of São Paulo with a focus on Nutrition, 2015.

Nutrients	Breakfast Mean (SE)			Lunch Mean (SE)			Dinner Mean (SE)			Total/day Mean (SE)	<i>p</i> -value (Total A-YA)*
	Home	Away from home	<i>p</i> -value*	Home	Away from home	<i>p</i> -value*	Home	Away from home	<i>p</i> -value*		
Adolescents											
Calories (kcal)	391.28 (12.43)	330.14 (29.37)	0.4821	549.42 (14.68)	493.73 (23.23)	0.5131	462.46 (13.51)	492.45 (37.42)	0.0992	2074.85 (32.46)	
SFA (g)	5.49 (0.29)	5.42 (0.48)	0.9052	9.79 (0.79)	11.43 (1.14)	0.2371	6.54 (0.36)	10.33 (0.51)	0.0445	21.43 (1.66)	
Sodium (mg)	629.57 (34.15)	616.80 (61.65)	0.8648	1249.03 (46.72)	1181.79 (56.78)	0.3169	1298.94 (43.40)	1690.87 (196.33)	0.0235	3072.5 (28.07)	
Added Sugars (g)	17.54 (1.22)	21.83 (3.28)	0.2547	14.64 (1.20)	20.38 (3.41)	0.0898	15.03 (1.49)	30.48 (5.52)	0.0078	56.99 (0.83)	
Young adults											
Calories (kcal)	397.80 (24.37)	374.29 (25.30)	0.325	625.50 (22.23)	488.93 (27.43)	0.8296	468.77 (31.32)	356.90 (25.60)	0.1092	2291.21 (58.75)	0.0035
SFA (g)	5.44 (0.31)	6.37 (1.29)	0.4734	8.67 (0.40)	8.20 (0.51)	0.4298	6.98 (0.64)	11.51 (2.02)	0.038	27.55 (1.42)	0.0422
Sodium (mg)	581.29 (37.54)	699.44 (145.13)	0.418	1495.20 (135.66)	1356.66 (91.63)	0.3864	1307.82 (85.66)	1798.97 (224.31)	0.0433	3119.70 (50.77)	0.2921
Added Sugars (g)	13.90 (3.78)	15.36 (1.50)	0.7156	14.64 (2.23)	16.42 (2.51)	0.6162	14.33 (2.17)	27.45 (3.80)	0.012	45.73 (1.11)	0.1776

Note: *Wald test comparing eating location with adolescents and young adults. Mean and SE: Standard Error; A: Adolescents; YA: Young adult. Analyses considered complex sample design for representativeness of the population of São Paulo. Means were adjusted for sex, race/ethnicity, marital status, income, and weight status. Significant values are bolded.

Regarding total energy consumption, the top five food/beverage sources ranged from 26.54%-75.42% (adolescents) and 23.65-82.65% (young adults) of total energy consumed at home or away from home: rice, yeast bread, beef, excludes ground, chicken, whole pieces and beans, peas, legumes. The top three food energy sources among adolescents at breakfast and lunch were the same at home and away from home (yeast bread, whole milk, margarine for breakfast, rice, beans, peas; legumes; and fruit drinks for lunch). The top three food energy sources among young adults at breakfast were similar at home (sugars and honey [13.85%], margarine [12.96%], and whole milk [12.69%]) and away from home (flavored powder [24.67%], whole milk [14.85%], and margarine [13.48%]). The main difference was what was consumed at home and away from home at dinner:

Table 3 – Food sources of energy and nutrients of public health concern¹ among adolescents according to their eating location. Health Survey of São Paulo with focus on Nutrition, 2015. (n=554).

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Category	%	Category	%
Energy			
Breakfast at home		Breakfast away from home	
Yeast bread	13.43	Yeast bread	12.09
Milk, whole	12.92	Milk, whole	10.95
Margarine	10.13	Margarine	9.71
Flavored powder	9.46	Butter and animal fats	9.46
Cheese	3.25	Cheese	9.34
Lunch at home		Lunch away from home	
Rice	14.81	Rice	11.99
Beans, peas, legumes	12.85	Beans, peas, legumes	9.10
Fruit drinks	5.02	Fruit drinks	8.21
Beef excludes ground	3.62	Chicken, whole pieces	6.34
Chicken, whole pieces	3.25	Chicken patties, nuggets, and tenders	5.76
Dinner at home		Dinner away from home	
Rice	16.94	Beef excludes ground	15.30
Beans, peas, legumes	12.01	Pasta-mixed dishes exclude macaroni and cheese	12.22
Soft drinks	7.31	Pork	6.84
Citrus juice	4.49	French fries and other fried white potatoes	5.97
Frankfurters	3.32	Soft drinks	5.63
Saturated fats			
Breakfast at home		Breakfast away from home	
Milk, whole	14.33	Pizza	16.65
Yeast bread	13.12	Yeast bread	13.44
Margarine	11.48	Butter and animal fats	10.66
Cheese	11.03	Margarine	10.03
Cookies and brownies	8.52	Crackers exclude saltines	5.58
Lunch at home		Lunch away from home	
Beef excludes ground	16.41	Chicken, whole pieces	10.99
Chicken, whole pieces	15.14	Turnovers and other grain-based items ²	7.05
Pasta-mixed dishes exclude macaroni and cheese	4.83	French fries and other fried white potatoes	6.52
Beans, peas, legumes mixed dishes	4.52	Meat mixed dishes	4.69
Frankfurters	4.11	Candy not containing chocolate	4.52
Dinner at home		Dinner away from home	
Beef excludes ground	9.12	Beef, excluding ground	11.38
Pasta-mixed dishes exclude macaroni and cheese	6.68	Meat mixed dishes	9.98
Other mixed dishes	4.62	Pizza	8.48
Rice mixed dishes	3.25	Ground beef	7.35
Chicken, whole pieces	2.99	Cold cuts and cured meats	5.33
Sodium			
Breakfast at home		Breakfast away from home	
Yeast bread	13.67	Yeast bread	18.05
Milk, whole	13.44	Crackers exclude saltines	13.88
Margarine	12.02	Margarine	10.25
Crackers exclude saltines	11.73	Butter and animal fats	9.69
Cheese	8.91	Cheese	8.48
Lunch at home		Lunch away from home	
Rice	13.57	Rice	12.49
Beans, peas, legumes	11.37	Beans, peas, legumes	9.47
Beef excludes ground	4.93	Beef excludes ground	5.22
Chicken, whole pieces	3.91	Chicken, whole pieces	5.08
Soft drinks	3.51	Soft drinks	4.68
Dinner at home		Dinner away from home	
Rice	13.57	Rice	22.23
Beans, peas, legumes	12.81	Beans, peas, legumes	11.85
Beef excludes ground	7.39	Beef excludes ground	11.44
Pork	5.54	Pasta-mixed dishes exclude macaroni and cheese	7.13
Pasta-mixed dishes exclude macaroni and cheese	4.34	Frankfurter sandwiches	7.09

Table 3 – Food sources of energy and nutrients of public health concern¹ among adolescents according to their eating location. Health Survey of São Paulo with focus on Nutrition, 2015. (n=554).

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Category	%	Category	%
Added Sugar			
Breakfast at home		Breakfast away from home	
Sugars and honey	18.82	Sugars and honey	17.38
Milk, whole	13.71	Coffee	17.12
Flavored powder	9.29	Milk, whole	14.72
Fruit drinks	4.53	Fruit drinks	13.26
Coffee	3.70	Cookies and brownies	7.87
Lunch at home		Lunch away from home	
Soft drinks	18.24	Fruit drinks	11.93
Meat mixed dishes	13.39	Frankfurter sandwiches	9.13
Tomato-based condiments	8.92	Tomato-based condiments	6.72
Fruit drinks	2.73	Candy containing chocolate	6.71
Cakes and pies	2.54	Soft drinks	6.10
Dinner at home		Dinner away from home	
Fruit drinks	7.35	Soft drinks	10.46
Citrus juice	6.30	Candy containing chocolate	8.29
Cakes and Pies	5.36	Smoothies and grain drinks	6.13
Candy containing chocolate	4.81	Cakes and Pies	3.84
Soft drinks	2.96	Ice cream and frozen dairy desserts	3.41

Note: ¹Added sugars, sodium, and saturated fats; ²Turnover and other grain-based items: *esfiha* and pot pies. Brazilian typical turnovers and other grain-based items: deep-fried chicken cake, cheese croissants, and other flavors.

Table 4 – Food sources of energy and nutrients of public health concern¹ among young adults according to their eating location. Health Survey of São Paulo with focus on Nutrition, 2015. (n=153).

1 of 2

Category	%	Category	%
Energy			
Breakfast at home		Breakfast away from home	
Sugars and honey	13.85	Flavored powder	24.67
Margarine	12.96	Milk, whole	14.85
Milk, whole	12.69	Margarine	13.48
Yeast bread	10.41	Yogurt, whole	11.61
Flavored powder	7.38	Coffee	10.04
Lunch at home		Lunch away from home	
Rice	12.54	Fruit drinks	16.42
Beans, peas, legumes	11.17	Rice	12.73
Beef excludes ground	6.59	Beans, peas, legumes	12.06
Citrus juice	6.15	Chicken, whole pieces	8.81
Chicken, whole pieces	5.88	Beef excludes ground	3.35
Dinner at home		Dinner away from home	
Rice	15.78	Pasta, noodles, cooked grains	13.28
Beans, peas, legumes	14.34	Beef excludes ground	10.09
Citrus juice	4.84	Salad dressings and vegetable oils	9.79
Soft drinks	3.53	Fruit juice	7.74
Frankfurters	3.74	Soft drinks	6.71
Saturated fats			
Breakfast at home		Breakfast away from home	
Margarine	19.37	Milk, whole	15.04
Yeast bread	9.95	Margarine	9.45
Milk, whole	7.12	Crackers exclude saltines	7.09
Cheese	4.61	Cakes and pies	4.87
Cream cheese, sour cream, whipped cream	4.23	Yeast bread	2.84
Lunch at home		Lunch away from home	
Beef excludes ground	11.18	Beef, excluding ground	12.82
Chicken, whole pieces	10.65	Cold cuts and cured meats	6.40
Pork	7.02	Candy containing chocolate	4.78
Sausages	6.70	Chicken, whole pieces	4.65
Cakes and pies	3.71	French fries and other fried white potatoes	2.65

Table 4 – Food sources of energy and nutrients of public health concern¹ among young adults according to their eating location. Health Survey of São Paulo with focus on Nutrition, 2015. (n=153).

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Category	%	Category	%
Dinner at home		Dinner away from home	
Beef, excluding ground	15.21	Beef, excluding ground	28.47
Butter and Animal fats	14.58	Butter and Animal fats	19.17
Sausages	11.41	French fries and other fried white potatoes	16.34
Pasta-mixed dishes exclude macaroni and cheese	8.66	Candy containing chocolate	12.67
Cream cheese, sour cream, whipped cream	7.25	Cakes and Pies	2.33
Sodium			
Breakfast at home		Breakfast away from home	
Milk, whole	13.75	Milk, whole	29.01
Margarine	11.58	Flavored powder	26.92
Flavored powder	9.05	Yeast bread	14.23
Yeast bread	8.46	Margarine	12.72
Cold cuts and cured meats	4.41	Cakes and pies	10.26
Lunch at home		Lunch away from home	
Rice	15.29	Tortilla, corn, and other chips	18.24
Beans, peas, legumes	9.81	Rice	10.03
Pasta, noodles, cooked grains	7.42	Pasta-mixed dishes exclude macaroni and cheese	6.41
Beef excludes ground	4.66	Beef excludes ground	5.60
Chicken, whole pieces	4.01	Burgers	4.75
Dinner at home		Dinner away from home	
Rice	19.29	Frankfurter sandwiches	17.12
Beans, peas, legumes	16.14	Meat mixed dishes	13.86
Soft drinks	8.16	Pizza	12.36
Beef excludes ground	5.20	Pasta-mixed dishes exclude macaroni and cheese	10.43
Salad dressings and vegetable oils	5.96	Rolls and buns	6.56
Added Sugar			
Breakfast at home		Breakfast away from home	
Sugars and honey	20.83	Sugars and honey	24.39
Rolls and buns	14.81	Yogurt, whole	18.77
Milk, whole	11.54	Flavored powder	16.12
Coffee	11.25	Cakes and Pies	15.25
Flavored powder	8.79	Jams, syrups, toppings	11.21
Lunch at home		Lunch away from home	
Meat mixed dishes	19.56	Soft drinks	26.38
Citrus juice	17.23	Sugars and honey	20.21
Candy not containing chocolate	11.17	Citrus juice	15.17
Soft drinks	8.31	Candy containing chocolate	8.93
Cakes and pies	6.80	Fruit drinks	6.92
Dinner at home		Dinner away from home	
Sugars and honey	18.51	Soft drinks	24.10
Fruit drinks	12.25	Fruit drinks	15.90
Cookies and brownies	9.78	Candy containing chocolate	13.33
Citrus juice	7.82	Sugars and honey	4.44
Cakes and Pies	6.57	Citrus juice	2.23

Note: ¹Add sugars, sodium, and saturated fats.

at home, the top three dishes were rice; beans, peas, and legumes; and citrus juice (young adults) or soft drinks (adolescents), while away from home, adolescents ate beef (excluding ground beef), followed by pasta-mixed dishes (excluding macaroni and cheese) and pork, and young adults ate pasta (noodles) and cooked grains, followed by beef (excluding ground beef) and then salad dressing and vegetable oil.

The five ranked food sources consumed at home on relative proportions of saturated fat were 26.66% and 78.98% for adolescents and young adults, respectively. Adolescents and young adults consumed similar saturated fat sources during breakfast at home: margarine, yeast bread, and

whole milk. However, there were differences in the foods consumed at breakfast away from home: adolescents consumed pizza (16.65%), yeast bread (13.44%), and butter and animal fats (10.66%), whereas young adults consumed whole milk (15.04%), margarine (9.45%), and crackers (excluding saltines) (7.09%). Foods consumed between age groups were also similar at lunch: the most popular food was beef (excluding ground beef) (adolescents: 16.41%; young adults: 11.18%), followed by chicken (whole pieces) (adolescents: 15.14%; young adults: 10.65%). Differences were found in foods consumed at lunch away from home; adolescents ate chicken (whole pieces) (10.99%), turnovers and other grain-based items (7.05%), and French fries and other fried white potatoes (6.52%). In contrast, young adults ate beef (excluding ground beef) (12.82%), cold cuts and cured meats (6.40%), and chocolate candy (4.78%). For dinner, both adolescents and young adults consumed the same top saturated fat food – beef (excluding ground beef) – at home (adolescents, 9.12%; young adults: 15.21%) and away from home (adolescents: 11.38%; young adults: 28.47%).

The five ranked food sources consumed at home on relative proportions of sodium were 37.29% and 93.14% for adolescents and young adults. Adolescents and young adults consumed similar foods during breakfast at home: adolescents ate yeast bread (13.67%), whole milk (13.44%), margarine (12.02%), and flavored powder (9.05%), and young adults consumed whole milk (13.75%), margarine (11.58%), and flavored powder (9.05%). The top three sodium sources for adolescents were the same for lunch and dinner: 1) rice, 2) beans, peas, legumes, and 3) beef (excluding ground beef), with variations in the contribution percentages. Regarding young adults' lunch and dinner at home, rice and beans, peas, and legumes took first and second place for both meals. However, sodium sources away from home differed; at lunch, they ate tortilla, corn, other chips (18.24%), rice (10.03%), and pasta-mixed dishes (excluding macaroni and cheese) (6.41%), while for dinner, they ate frankfurter sandwiches (17.12%), meat-mixed dishes (13.86%), and pizza (12.36%).

Regarding consumption of added sugar, the top five food/beverage sources of added sugar ranged from 22.78–75.74% (adolescents) and 25.25–65.92% (young adults) at home or away from home on the three eating occasions: white sugar granulated, whole milk, coffee, fruit drinks, and soft drinks. The top added sugar source consumed by adolescents and young adults during breakfast at home and away from home was sugars and honey (18.82%, 17.38%, and 20.83%; 24.39%). At lunch, differences were observed between age groups for food eaten at home and away from home: adolescents consumed soft drinks (18.24%), meat-mixed dishes (13.39%), and tomato-based condiments (8.92%) at home and fruit drinks (11.93%), frankfurter sandwiches (9.13%), and tomato-based sauces (6.72%) away from home. At lunch, young adults consumed meat-mixed dishes (19.56%), citrus juice (17.23%), non-chocolate candy (11.17%) at home and soft drinks (26.38%), sugars and honey (20.21%), and citrus juice (15.17%) away from home. At dinner, mainly sweetened were important sources of added sugar – at home: fruit drinks (adolescents: 7.35%; young adults: 12.25%), away from home: soft drinks (adolescents: 10.46%; young adults 24.1%). The sweets: non-chocolate candy, cakes and pies, cookies and brownies, ice cream, and frozen dairy desserts were top sugar sources at dinner and lunch in both eating locations.

DISCUSSION

This study assessed the food sources of energy and overconsumed nutrients of public health concerns among adolescents and young adults according to their eating locations and occasions. In Brazil, adolescents and young adults consume most meals at home. Results showed that only at dinner, meals away from home tended to be higher in SFAs, sodium, and added sugars than those at home. Overall, young adults had a higher intake of calories and SFAs than adolescents. Even

without considering eating occasion, this finding is similar to another study with Brazilian adolescents ($n=36,956$), which found a relatively large proportion of their daily calories and added sugars came from away-from-home sources [34].

The most significant calorie contributors for both age groups at home and away from home were milk, yeast bread, and margarine, commonly eaten for breakfast [35]. At lunch and dinner, core foods, including rice, beans, and meat, are considered important for dietary habits and are the most consumed foods in Brazil [36]. For dinner, pasta was frequently consumed away from home, while rice and beans were commonly eaten at home. We observed that sodium sources mainly corresponded to breakfast, lunch, and dinner core foods, especially for away-from-home dinner non-core foods such as frankfurter sandwiches, meat-mixed dishes, and pizza. Awareness of sodium in processed foods and controlling sodium use in the food industry is just as important as being conscious of adding salt in food preparation at home [37]. This point is particularly relevant because Brazilians consume, on average, 9.34 g of salt per day – almost double what the WHO recommends (5 g). The perception of high sodium consumption could be higher, suggesting that sodium added while cooking at home may be neglected, and our environment can contribute to this practice [38].

SSBs, soft drinks, and fruit drinks (e.g., artificial fruit juice) were among the top energy sources and added sugars at home and away from home for adolescents and young adults. Furthermore, citrus juice (e.g., natural orange juice and lemonade) was frequently drunk at home. These results are consistent with nationwide studies conducted with Brazilian and Latin American participants aged 12+ who indicated a preference for these beverages [18,39]. In addition to beverages, sugars, and honey were the main sources of added sugars at breakfast. Nonchocolate candy was frequently consumed at dinner, followed by cakes and pies, ice cream and frozen dairy desserts, and cookies and brownies. These results are consistent with a food consumption pattern characteristic of Brazilians in this age group that has already been reported by extensive studies such as the Brazilian Study of Cardiovascular Risks in Adolescents and the Brazilian Household Budget Survey [40,41]. However, emphasizing that poor weight perception is related to unhealthy eating habits is critical [41].

The main contributing foods for saturated fat were butter and animal fats, margarine, beef, chicken, milk, bread, and crackers, which were similar to what was found for sodium and added sugars; the major differences corresponded to meals away from home for both lunch and dinner in the type of foods consumed (e.g., French fries, pizza, and chocolate candy). These processed foods are often consumed away from home [42,43].

Adolescents' overall diet quality needs improvement (mean score=54.46/100 [0.56]), as does their saturated fat intake (mean score=6.50 [0.17] out of 10) and total calorie intake from solid fats, alcohols, and added sugars (SoFAAS) (mean score=7.62/20 [0.29]) according to a previous study of ISA-Capital 2015 data [44]. Similarly, a study using Brazilian Household Budget Survey data showed that people who frequently consumed SoFAAS had a higher intake of SSBs, cookies, cakes, processed meats, chips, candy, chocolate, sandwiches, and snacks than those who moderately consumed SoFAAS [45]. These results underscore the importance of promoting healthy diets both at home and away from home. Family-based interventions that clarify the associations between food choices and health-related problems and multiple-component interventions, including parents' involvement, cooking classes, and private counseling, may result in improved dietary behaviors in these populations [46-48].

The food environment and the greater availability of places close to home and food marketing may contribute to the consumption of industrialized foods that usually have high amounts of saturated fat, sodium, and added sugars. In this regard, important measures, such as the front

labeling of foods was a significant advance for Brazil; the measure that aims to reduce the specific consumption of these three nutrients of most important concern in public health can contribute to consumers making healthy food choices improving diet quality of these populations evaluated [49].

The current study had two unique strengths. First, it targeted a representative sample of individuals living in the most prominent Brazilian city, differentiating it from other studies that have analyzed the dietary intake and consumed foods from non-representative samples in Brazil and other low- and middle-income countries [17,22,42]. Second, the study involved an integrative diet analysis by analyzing food groups through a version of the food classification system adapted to represent foods commonly consumed in the Brazilian context.

Nevertheless, despite these strengths, the study has several limitations. First, the study relied on self-reported measures of food consumption, which may limit the objectivity of the results. Second, participants were recruited from a single Brazilian city, which may limit the generalizability of the study findings to other Brazilian populations and temporal lapse between the data collection and the publication due to possible changes in population profile and food consumption. Finally, some foods were classified as mixed dishes based on standardized recipes, which may underestimate mixed dishes and homemade fast foods outside the standardized recipes. Additionally, the food classification system may need to be revised to better distinguish between ready-to-eat dishes (e.g., frozen meals) and dishes made from scratch. Nevertheless, ready-to-eat dishes are irrelevant energy contributors in the Brazilian diet because they represent less than 5% of the total daily energy consumed.

CONCLUSION

Young adults from São Paulo consumed more calories and saturated fats than adolescents. Adolescents and young adults consumed higher amounts of saturated fats, added sugars, and sodium for dinner away from home than at home. Foods and beverages with the highest energy, saturated fat, and sodium content consumed at home and away from home were similar, except those eaten for dinner. Based on the results, public health policies and behavioral change strategies should be considered in the context of adolescents and young adults regardless of eating location, as these age groups are exposed to large amounts of food sources of sugars, sodium, and saturated fats. Regarding eating occasions, special attention should be paid to the 6–9 pm (dinner) period and main meals outside the home.

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